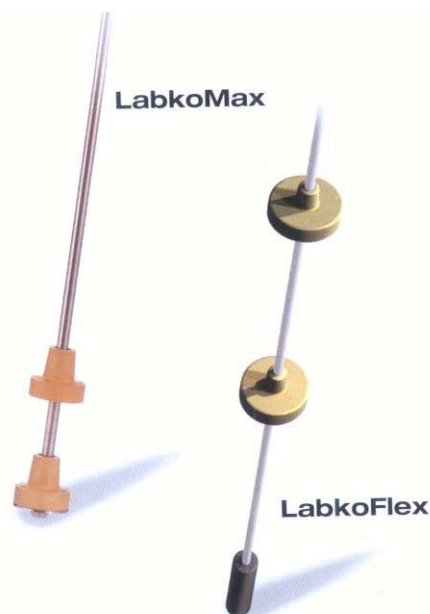


LabkoMax[®]

MPS-4 Level Interface

7100 series LabkoMax and LabkoFlex probes

INSTALLATION AND OPERATING INSTRUCTIONS



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1. GENERAL

1.1 LABKOMAX LEVEL MEASUREMENT SYSTEM

The LabkoMax level measurement system contains the following devices and software:

7100 series magnetostrictive LabkoMax and LabkoFlex level probes

MPS-4 level interface (power supplies and Ex-barriers)

MD-1 Current loop / RS-232 converter

ME-3 Display unit

LabkoMonitor 8 Fuel tank monitoring software

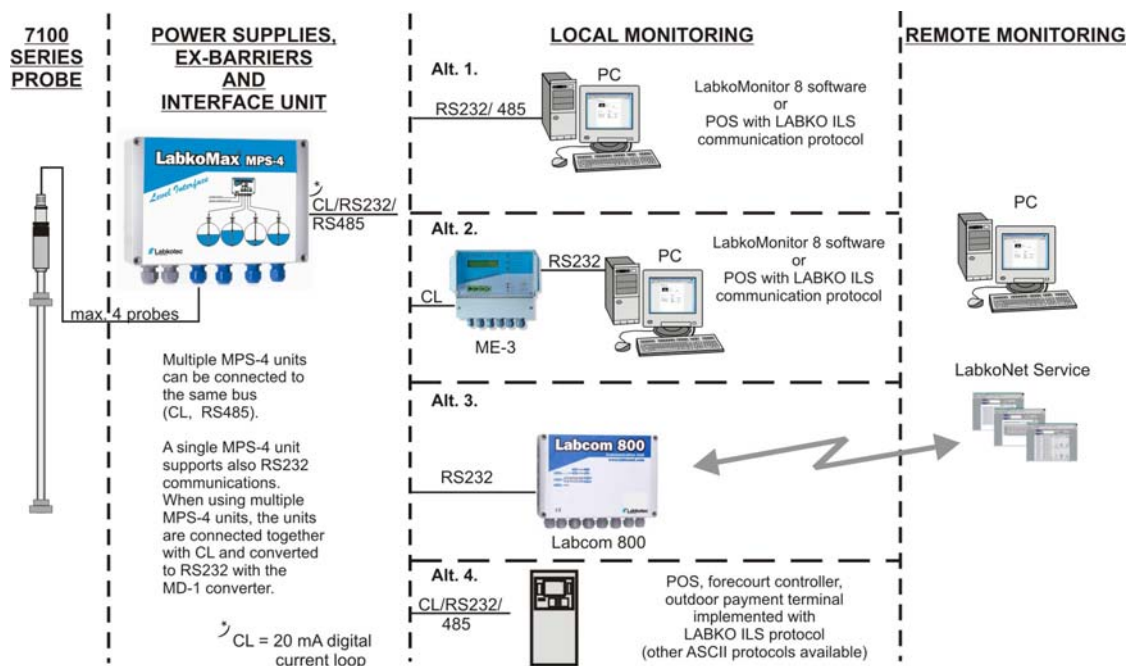


Fig. 1. LabkoMax measurement system alternatives.

Additional information can be found in following documents:

LabkoFLex	Installation and handling procedure (Doc. No. D30660)
MD-1	Current loop / RS-232 converter, installation and operating instructions (Doc. No. D30165)
ME-3	Installation and user manual (Doc. No. D30013)
Labcom 800	Operating and Installation Instruction (Doc. No. D04063)
LabkoMonitor 8	Installation and Operating Instructions (Doc. No. D30643)
LabkoMax Configurator	
Installation program	Installation and Operating Instructions (Doc No D30640)
LabkoNet	www.labkonet.com

1.2 TECHNICAL SPECIFICATIONS

LabkoMax MPS-4 Level Interface	
Number of probes:	1...4 pcs 7100 series LabkoMax or LabkoFlex probes
Output values:	Product level, product volume, water level, water volume and temperature
Output format:	Digital serial communication in 20 mA current loop using LABKO ILS protocol, 300...4800 baud. Optional RS-485 MODBUS
Level resolution:	0,1 mm
Level linearity:	$\pm 0,01\%$ FS tai $\pm 0,25$ mm (whichever is greater)
Volume resolution:	0,1 l
Water level resolution:	0,1 mm
Temperature resolution:	0,01°C
Temperature accuracy:	$\pm 0,3^\circ\text{C}$ (-20 ... +65°C)
Configuration:	With code switches and through the serial port with Windows based LabkoMax Configurator Installation program
Power supply:	230 ($\pm 10\%$) VAC, 50/60 Hz, 4,5VA
Operation temperature range:	-20 ... +50°C
Enclosure protection class:	IP65
Dimensions:	250 x 175 x 75 mm
Ex-classification:	Ex II (1) G [Ex ia] II B VTT 03 ATEX 079X
Special conditions:	Ta = -25°C ... +50°C
Output values IIB:	Uo = 30 V Io = 117 mA Po = 883 mW Co = 320 nF Lo = 5 mH Lo/Ro = 159µH/Ω Linear output. See chapter 2.3
Cabling requirements:	To probes: shielded twisted pair, max. length 600 m. To host: instrument cable 1x(2+1)x0,5 mm ² , max. length 400 m.
Options:	Isolated serial communication converter RS-232/485, 300...19200 Bd
EMC:	
Immunity	EN 50082-1 EN 50082-2
Emission	EN 50081-1
Year of manufacture: See serial number from the type plate	AAA(006) B CCC DD EE F where EE = year of manufacture (e.g. 10 = 2010)

2. INSTALLATION

This manual describes the installation of the 7100 series LabkoMax probe and the MPS-4 level interface unit. LabkoFlex probe is provided in it's own installation manual (see page 3).

Installation instructions for the ME-3 display unit MD-1 current loop / RS-232 converter, and LabkoMonitor 8 monitoring software are provided in their own manuals (see page 3).

2.1 INSTALLATION OF THE 7100 SERIES LabkoMax PROBE

The probe must be installed to 2", 3" or 4" riser pipe. For installation, there must be a welded sleeve fitted with R2", R3" or R4" internal thread on the top of the tank. Recommended riser pipe length is 550 mm.

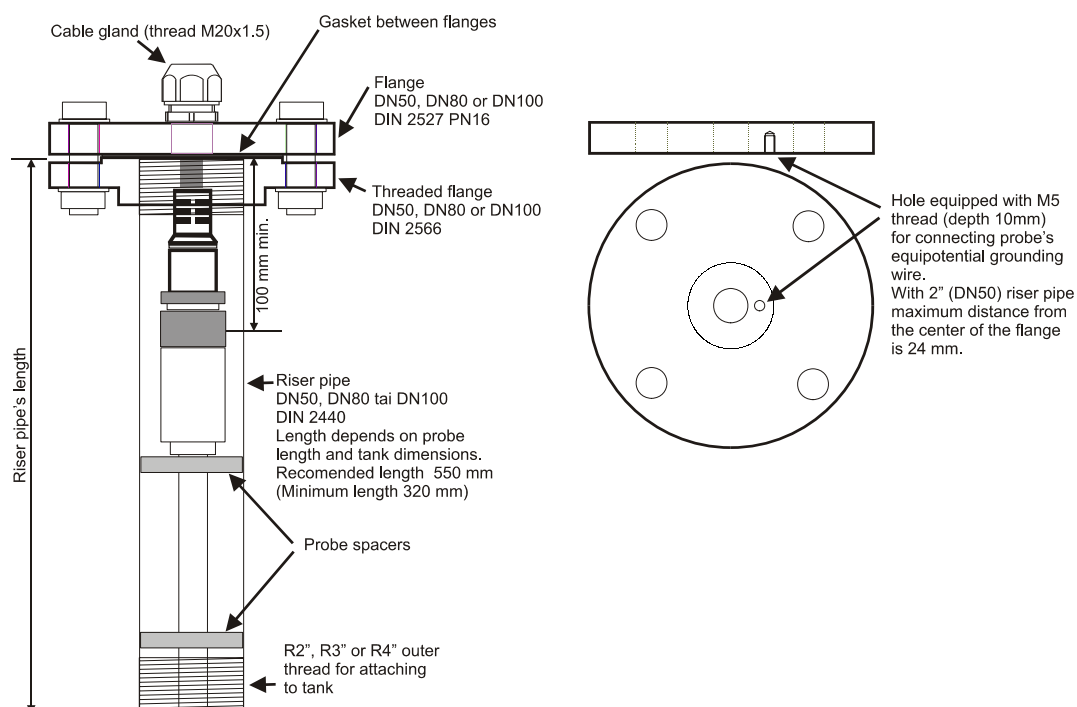


Fig. 2. Riser pipe

Example of determining riser pipe length		
Height measured from bottom of the tank to manhole cover in mm	Total length of the probe in mm	Minimum riser pipe length in mm.
1700	2080 (82")	480
2100	2490 (98")	490
2600	3000 (118")	500

In the above table it is taken into account that here must be at least 100 mm between top of probe to riser pipe's top flange.

Total length of the probe in the above table is the length that must be used when ordering the probe. Values indicated in the table are standard lengths available in the stock.

Before installation, write down the wire speed of the measurement signal of each probe. The wire speed is located in the label at the probe head, for instance WS: 9.064 uSEC/INCH.

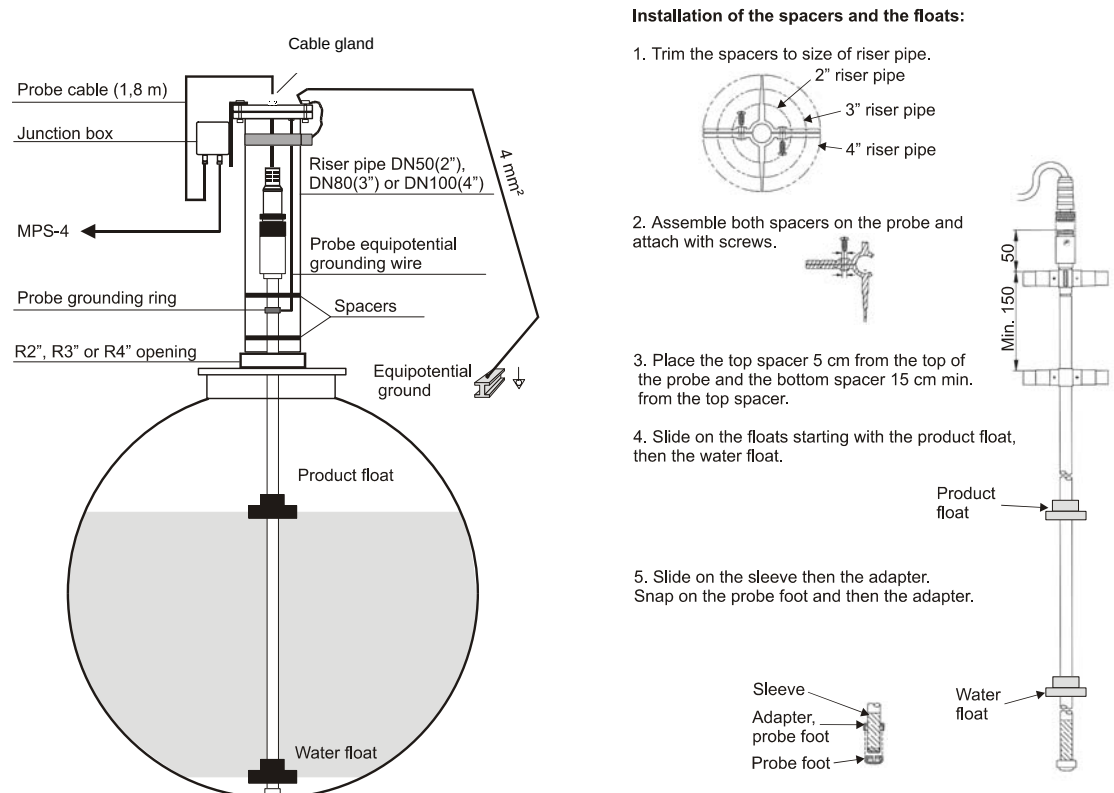


Fig. 3. Installation of the probe.

The installation is carried out as follows:

- install the riser pipe to the tank.
- install probe spacers, probe grounding ring, floats, protecting sleeve, probe foot fastening adapter and probe foot to the probe. Product float must be above the water float. With 2'' steel floats product float and water float are identical, but there is metal collar above the water float to add weight, and second collar under the water float to prevent lowering the water float under the probe's measuring range. 3'' and 4'' polyurethane water floats have ballast plate on bottom. Insure that you are using a proper water float: for gasoline there is stamped 85 on the ballast plate and for diesel there is 95.
- screw the connection cable to the probe
- slide the floats to the bottom of the probe shaft. Note: The product float must be above water float. Insert the probe in the riser pipe and lower it to the bottom of the tank.

-
- The diagram illustrates the electrical connection and grounding for the MPS-4 probe. On the left, a detailed view of the 'Junction box' shows five terminals labeled 1 through 5. Terminal 1 is marked with a '-' sign, terminal 2 with a '+' sign, and terminal 3 with a ground symbol. Wires are connected as follows: a black wire to terminal 1, a white wire to terminal 2, and a green wire to terminal 3. The black and white wires are bundled together and labeled 'Probe' at the bottom. The green wire is labeled 'MPS-4' at the bottom. On the right, a schematic shows the probe assembly mounted on a riser pipe. A 4 mm² cable runs from the junction box to the probe. This cable branches into two paths: one labeled 'Riser pipe equipotential grounding' which connects to the riser pipe, and another labeled 'Probe equipotential grounding' which connects to the probe. Both the riser pipe and the probe are shown connected to a common 'Equipotential ground' plane at the bottom.

Junction box is normally connected to the system's equipotential ground via mounting plate and riser pipe's cover flange, but if this not the case, then junction box must be connected to the equipotential ground with at least 4 mm² wire.

- the space above the entry must be free to allow the installation and service of the probe (it must be possible to lift up the probe from the tank)
- the installation shaft shall be sufficiently large (diameter ≥ 1 m) to allow the installation and connection of the probe

2.2 INSTALLATION OF THE MPS-4 LEVEL INTERFACE UNIT

The MPS-4 must always be installed in the non-hazardous area. The protection class of the unit's enclosure (dust tight and jet proof to IP 65) must be taken into account. The MPS-4 can be mounted permanently on wall or in a device cabinet in the field, for example.

The unit is fastened with four screws through the holes in the corners of the housing.

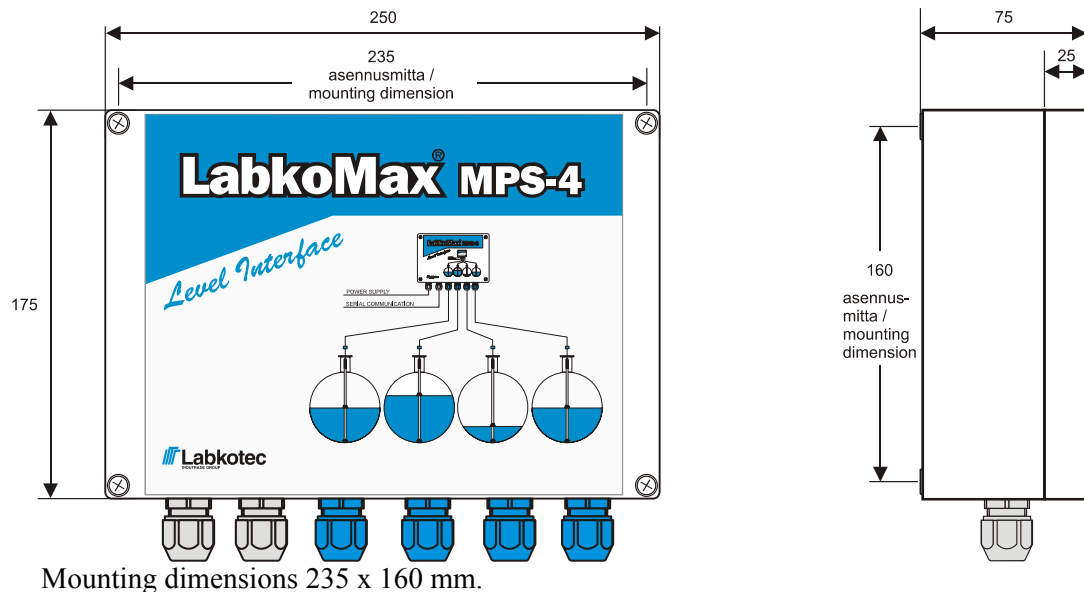


Fig. 5. MPS-4 mounting dimensions.

2.3 CABLING

NOTE! MPS-4 control unit must not be installed in explosion-hazardous zone.

However, it is allowed to install the 7100-probe in explosion-hazardous zone (0/1/2). When doing so, the following standards need to be followed; EN 50039 Electrical apparatus for potentially explosive atmospheres – Intrinsically safe electrical systems “I”, EN 60079-14 Electrical apparatus for explosive gas atmospheres. Part 14: Electrical installation in hazardous areas.

The table below shows the maximum combined capacitance and inductance values for explosion group IIB for the MPS-4 control unit. For group IIA, values for IIB can be applied.

IIB	
Co	Lo
320 nF	0,15 mH
240 nF	1 mH
210 nF	2 mH
180 nF	5 mH

A shielded 2-conductor cable must be used between the MPS-4 unit and the probe. When cable conductors have at least 0.5 mm² cross section, maximum cable length is 600 meters if capacitance and inductance values are within allowed limits.

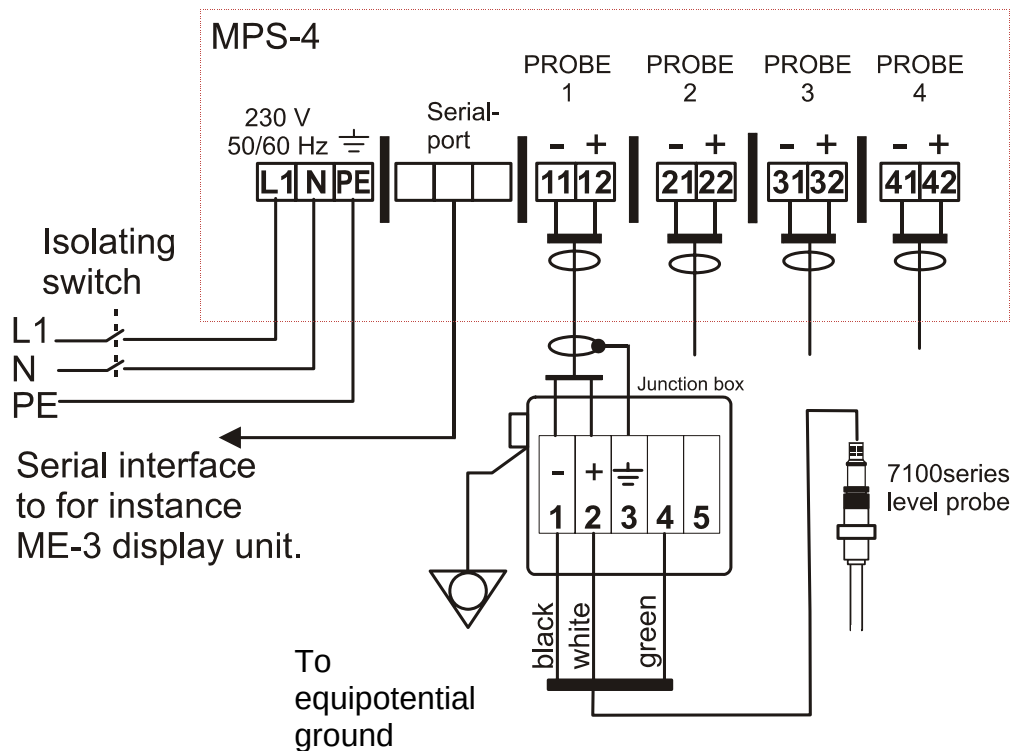


Fig. 6. Connection between the MPS-4 and the 7100 probe.

The cable between the 7100 probe and the MPS-4 level interface unit is connected as shown in the figure 6. The cable shield is connected to terminal 3 in the junction box. At the MPS-4 end of the cable the shield is not connected and it must be isolated (for example by insulating tape).

The riser pipe and all other metal parts must be connected to the system's equipotential ground by conductor having at least 4 mm² cross section.

The mains supply to the MPS-4 (230 Vac) is connected to the terminals marked L1, N and PE.

MPS-4 units mains supply lines must be equipped with decoupling switch (250Vac/1A) to ease use and maintenance. This switch must be located near the MPS-4 unit and must be labeled as unit's decoupling switch.

All connections should be appropriately made and checked before connecting mains supply.

For the current loop cabling between the MPS-4 level interface units and the host unit (such as ME-3), it is recommended to use a 2-conductor shielded cable with a minimum

conductor area of 0.5 mm². When using this type of cable, the total current loop length can be up to 400 m.

The current loop from the MPS-4 to the host unit is connected to CL+ and CL- terminals on the LINE connection. The cable shield is connected to the terminal 1. This potential free terminal is designed to be used as an extension terminal for the shields of the cables of series connected MPS-4 units. When using several MPS-4 units, the current loop connections (LINE) of these units are connected in series.

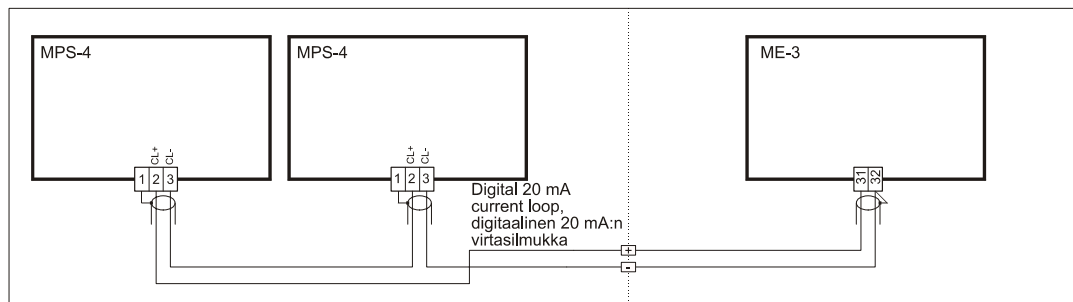


Fig. 7. Connecting several MPS-4 units in series.

The digital 20 mA current loop of the MPS-4 can be converted into an RS-232 serial interface using the RS-232/485 adapter card for MPS-4. The RS-232 interface is needed when using the LabkoMonitor 8 software or connecting the MPS-4 to a modem or POS.

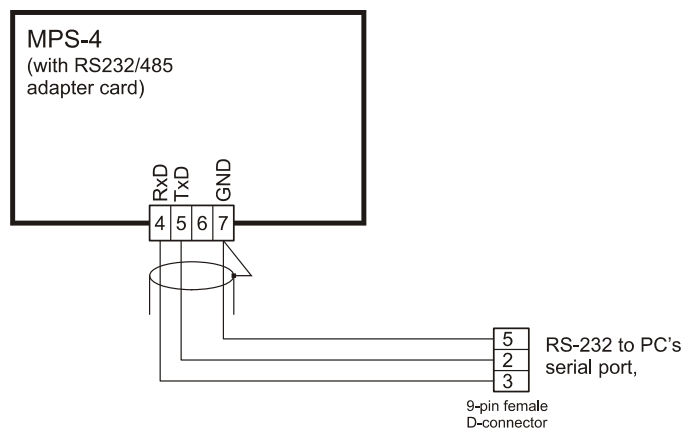


Fig. 8. MPS-4 RS-232 interface using optional RS-232/485 adapter card.

When connecting multiple MPS-4 units to a host controller with RS-232 communication, the units are connected in series with current loop and converted to RS-232 using MD-1 converter. See the MD-1 manual for additional information.

3. MPS-4 CONFIGURATION AND SETTINGS

The configuration of the MPS-4 is done with three rotary switches and with ASCII commands using the serial communication port of the MPS-4.

The rotary switches are located in upper left corner of the circuit card. The settings from these switches are detected only on powering up the MPS-4, so if the settings are changed the power supply for the MPS-4 must be reconnected or the RESET button must be pressed.

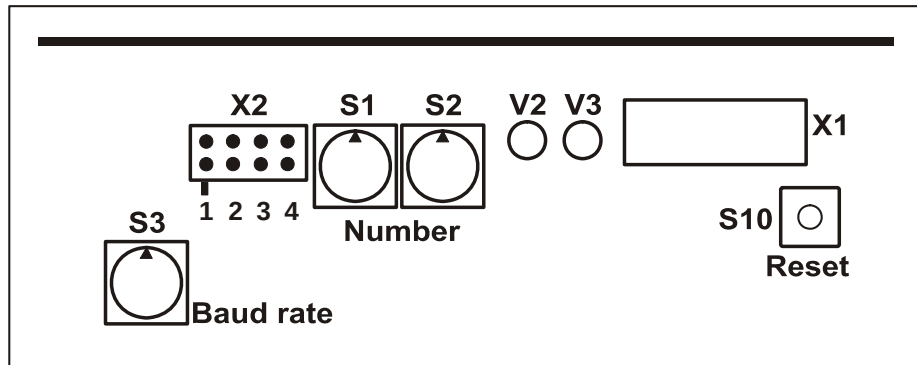


Fig. 9. MPS-4 configuration switches at the upper left corner of the circuit board.

The six switches (S4...S9) behind the current loop terminals (CL+, CL-) must all be in the right hand position.

Measurement settings are made using computer (PC) with RS-232 communication port. If MPS-4 unit is not equipped with RS-232/485 adapter card, then digital current loop/RS-232 converter MD-1 (or equivalent) must be used. If MPS-4 unit is connected to ME-3 display unit, then settings can be made through the RS-232 port of the ME-3.

Settings can be made with LabkoMax Configurator program (Windows) or Windows Hyperterminal.

3.1 COMMUNICATION SETTINGS

3.1.1 BAUDRATE SETTINGS

The communication speed of the MPS-4 serial port is selected with switch S3. The settings are:

switch position	communication speed
0	300 bd (default, used with ME-3)
1	1200 bd
2	2400 bd (default with Labcom 800)
3	4800 bd
4	9600 bd (RS232/485 only)
5	19200 bd (RS232/485 only)

The other communication parameters are: 8 data bits, 1 stop bit, no parity.

3.1.2 RS-232/RS-485 SETTINGS

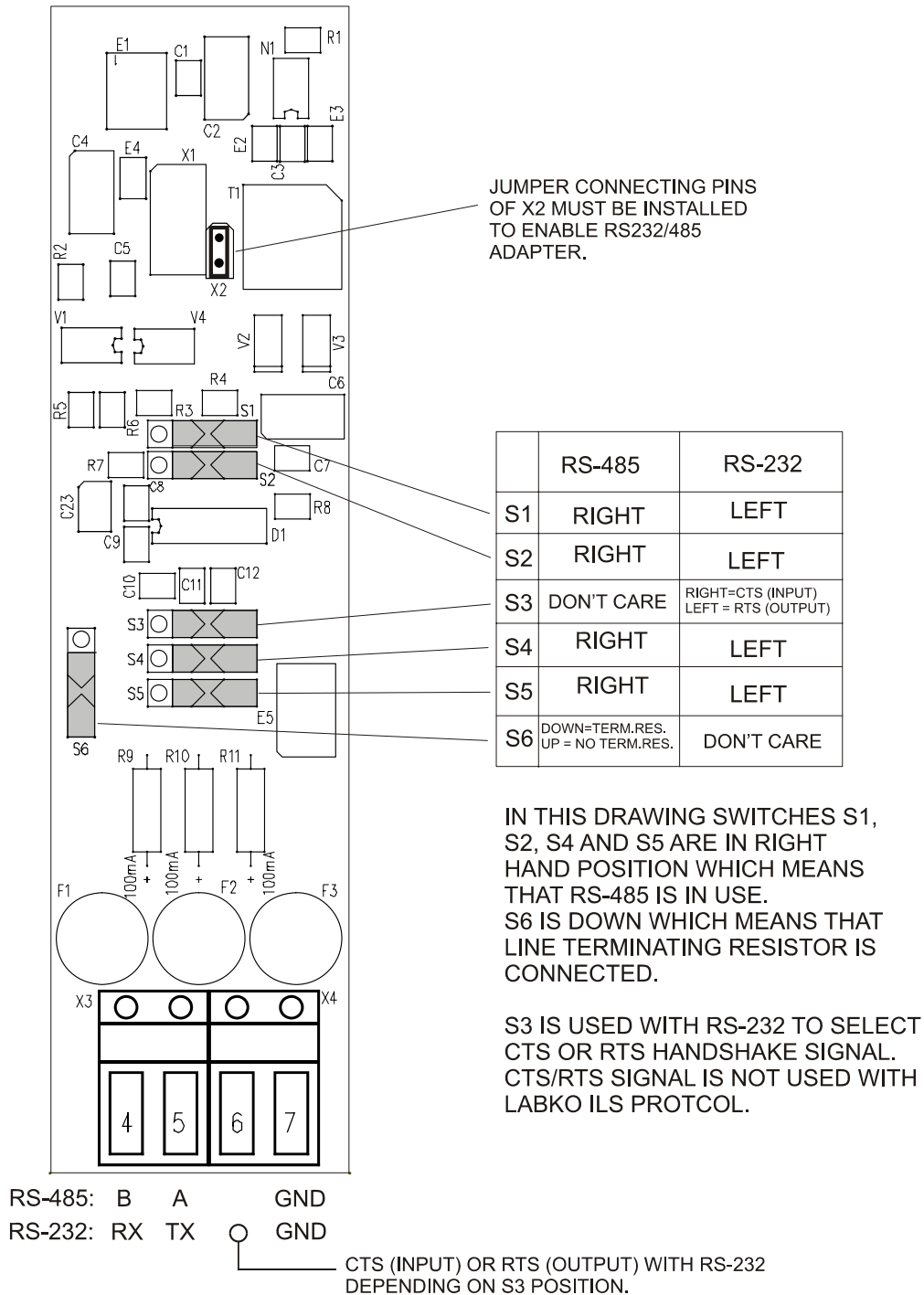


Fig. 10. LabkoMax MPS-4 adapter, switch positions

If there are multiple MPS-4 units connected to the same RS-485 line, then termination resistor must be activated only in the unit at the end of the line.

3.2 SETTING THE PROBE IDENTIFICATION NUMBERS

In this system each probe has it's own identification number. The number range is from 01 to 99. There are four connectors for probes (PROBE 1,2,3,4) in the MPS-4. The number of the first probe (PROBE 1) is set by two rotary switches. The rest three probes are automatically numbered in ascending order (number of the previous probe plus one). For instance, if the number of the first probe is set to 01, then PROBE 2 is 02, PROBE 3 is 03 and PROBE 4 is 04.

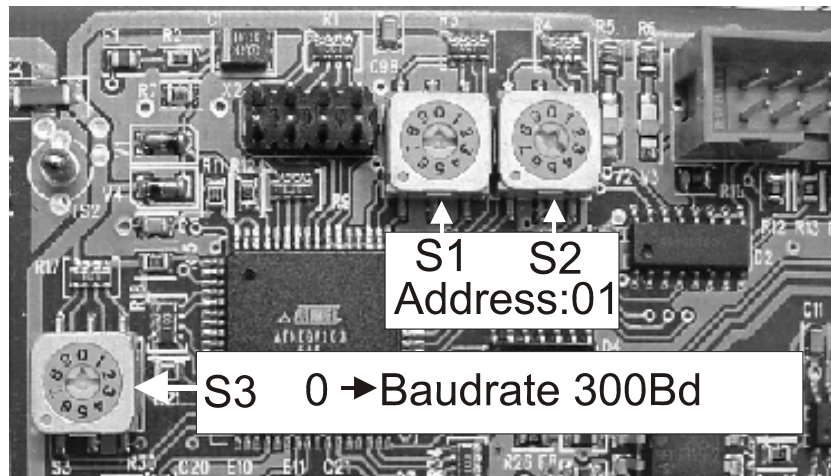


Fig. 11. Rotary switches S1, S2 and S3.

If there is no probe connected to a probe connector, that number is still reserved. PROBE 1 terminals are 11 and 12 (left hand side on the circuit board), PROBE 2 terminals 21 and 22, PROBE 3 terminals 31 and 32, PROBE 4 terminals 41 and 42.

If two MPS-4 units are used then identification numbers must be set so that number ranges do not overlap. Example: If first unit's identification number rotary switches are set to 01, then second unit's rotary switches must be set to 05 or higher.

3.3 SETUP COMMANDS

The most important setup commands of the MPS-4 interface are explained below. Commands can be given with Windows based LabkoMax Configurator software or by means of PC's communication program.

The settings for the communication between PC and MPS-4 are: baud rate (the same as set to MPS-4), 8 data bits, 1 stop bit, no parity.

Using the setup commands requires that a serial RS-232 interface is available for the MPS-4. Such an interface is incorporated in the RS232/485 adapter for MPS-4, MD-1 and ME-3 units, for example.

At the startup there must be at least the following two settings made correctly:

- **Setting the wire speed** of the measurement signal (3.3.1).
- **Probe type setting** (3.3.2).
- **Setting the level measurement** (3.3.3).

Notice: Setting the wire speed must be carried out before any other settings.

Because the product float cannot mechanically descent to position corresponding zero level measured from the bottom of the tank, it is useful to specify minimum level value under which level is always interpreted to be zero. This minimum level value is set by:

- **Setting the minimum product level** (3.3.4).

Number of floats setting:

- **Number of floats setting** (3.3.5)

If the product float and the water float touch each other and do not float freely, level measurement is not accurate. Therefore minimum float distance is specified by:

- **Setting the minimum float distance** (3.3.6).

Reading of probe status (5.1) can be used to ensure the floats are not closer to each other than specified by minimum float distance.

To be accurate, water bottom measurement requires:

- **Setting the water float offset** (3.3.7).

As with the product float, the water float can not descent to zero level measured from the bottom of the tank either, and following setting is needed:

- **Setting the minimum water level** (3.3.8).

Some settings are dependant of the float type and therefore following setting can be used to check these settings:

- **Setting the float type** (3.3.9)

Method of calculation of the volume of the product is specified by:

- **Setting the result mode** (3.3.10).

If result mode is set to zero, then no additional settings are needed to calculate volume because level/volume inquiry returns level of the product. If result mode is set to one, then following settings must be carried out:

- **Setting the volume of the tank** (3.3.11).
- **Setting the diameter of the tank** (3.3.12).

If result mode is two, the user specified conversion table is used. Following commands are used to set the conversion table:

- **Erasing the conversion table** (3.3.13).
- **Filling in the conversion table** (3.3.14).

Conversion table can be displayed by **read conversion table command** (3.3.15). To make corrections to already filled conversion table, following commands are useful:

- **Setting the number of points in the conversion table** (3.3.16).
- **Correct conversion table point** (3.3.17).

Level and volume inquiries contain status of the limits which are set by following commands:

- **Setting the low level alarm** (3.3.18).
- **Setting the high level alarm** (3.3.19).
- **Setting the condensed water alarm** (3.3.20).

Setting can be displayed by **read parameters command** (3.3.21).

All commands are made up of two characters, a two-digit probe number and a parameter, if any. The command is ended by pressing the ENTER key (RETURN, carriage return). The probe number is used to address the command to the desired probe.

In the command instructions the following markings are used:

n_1n_2 probe number (01...99)
<CR> carriage return (RETURN, ENTER)

The MPS-4 responds to all setup commands executed and acknowledged using two characters: #<CR>.

3.3.1 SETTING THE WIRE SPEED

$\$Yn_1n_2x_1...x_4<CR>$

Each probe has its own speed of wire value. The speed of wire is marked on the label on probe head. This value is given as an integer in the place of $x_1...x_4$ for the probe in question, for instance the wire speed 9.034 μ s/inch for the probe 01 is given as **$\$Y019034<CR>$** .

This value is shown as **WireSpeed** in the output of the RP command.

3.3.2 PROBE TYPE SETTING

$PTnnt,$

where nn is probe number (01,...,99) and t (1,...,6) is probe type.

Types 1,4 0"< probe length <=216"

Types 2,5 216"< probe length <=288"

Types 3,6 288"< probe length

Probe types 1, 2 and 3 have 5 thermistor probes (R5 designation in part number).

Probe types 4, 5 and 6 have 1 thermistor probes (R1 designation in part number).

Default value for probe type is 4.

3.3.3 SETTING THE LEVEL MEASUREMENT

\$Zn₁n₂m₁...m₄<CR>

This command is used to calibrate the level readout to correspond to the actual level measured by a gauge stick from the bottom of the tank. The measured value is given as parameter m₁...m₄ in millimetres.

The level of the product must be at least 200 mm to execute the level setting command.

Example. If the level is measured to be 1557 mm in the tank with probe's identification number 01, then following command is given:

\$Z011557<CR>

3.3.4 SETTING THE MINIMUM PRODUCT LEVEL

LMn₁n₂m₁...m₄<CR>

This parameter is given as tenths of millimetre and specifies level under which level is displayed as zero. Because the product float cannot descent to position corresponding zero level measured from the bottom of the tank, there is minimum level under which level can not be measured. Because the product float is above the water float minimum level must be at least height of the water float added by sinking depth of the product float. If 2" steel floats are used, then collars above and under the water float must be taken into account. In the table collars are assumed to be 10 mm high. Following table contains minimum level measured from the bottom of the tank for different floats. Values in the table are based on measurement which were made with the floats and various liquids. Because actual conditions can differ from measurement conditions, more accurate values can be determined when measurements are made in real operating environment.

Float type	Minimum level in mm from the bottom of the tank that can be measured	Parameter value with the setting command
2" steel	149	1490
2" nitrophyl	176	1760
3" polyureth.	82	820
4" polyureth.	79	790

Example. Probe with identification number 01 is equipped with 3" floats. Minimum level is set to 82.0 mm using following command:

LM01820<CR>

This value is shown as **MinLevel** in the output of the RP command.

3.3.5 NUMBER OF FLOATS SETTING

FCnnk,

where nn is probe number (01,...,99) and k (1,2) is number of floats.

Default value is 2.

3.3.6 SETTING THE MINIMUM FLOAT DISTANCE

MDn₁n₂m₁...m₄<CR>

Minimum float distance which is given in tenths of millimetre specifies how close to each other floats can be without causing errors to measurement. Because the probe measures position of the magnets attached to the floats, this parameter means minimum distance of the magnets. With 2" steel floats weighting collar above the water float must be taken into account and in the following table it is assumed to be 10 mm high.

Float type	Minimum distance in mm	Parameter value with the setting command
2 " steel	86	860
2" nitrophyl	78	780
3" polyureth.	65	650
4" polyureth.	71	710

Example. Probe with identification number 01 is equipped with 3" floats. Minimum distance is set to 65.0 mm using following command:

MD01650<CR>

This value is shown as **MinFloatDist** in the output of the RP command.

3.3.7 SETTING THE WATER FLOAT OFFSET

FDn₁n₂m₁...m₄<CR>

The water float offset, which given in tenths of millimetre, is used to correct the difference in floating depths of the product float and the water float. Given value is added to the measured water level. A positive value must be given if measured water level is lower than the actual water level.

Float	Difference in floating depths in mm		Parameter value with the setting command	
	gasoline	diesel	gasoline	diesel
2 " steel	-3	-13	-30	-130
2" nitrophyl	-70	-62	-700	-620
3" polyureth.	3	11	30	110
4" polyureth.	-6	3	-60	30

Notice: Values in the above table are only approximate. More accurate values can be acquired by measuring floating depths in actual situation.

Example. Probe 01 is equipped with 3" floats. Water float offset is set to 11.0 mm by following command:

FD01110<CR>

This value is shown as **WfOffset** in the output of the RP command.

3.3.8 SETTING THE MINIMUM WATER LEVEL

WMn₁n₂m₁...m₄<CR>

This parameter which given in tenths of millimetre is needed because, as with the product float, the water float can not descent zero level measured from the bottom of the tank. Water levels below this value are displayed as zero.

NOTE! The values mentioned in the table below are only estimates. The actual setting should be done as follows.

1. Set the value of minimum water level first to a value of 0 mm.
2. Check the value of condensed water level with command \$G (chapter 4.4).
3. Set the minimum water value to a value which is 2 mm higher than just checked.
4. Check the condensed water level again. It should now be 0 mm.

Float	Minimum water level in mm		Parameter value with the setting command	
	gasoline	diesel	gasoline	diesel
2 " steel	74	64	740	640
2" nitrophyl	30	38	300	380
3" polyureth.	18	26	180	260
4" polyureth.	6	15	60	150

Example. Probe 01 is equipped with 3" floats and measures level gasoline level. Minimum water level is set to 18.0 mm by following command:

WMn₁n₂m₁...m₄<CR>

This value is shown as **MinWater** in the output of the RP command.

3.3.9 SETTING THE FLOAT TYPE

FTn₁n₂x<CR>

This command is used to set the type of the floats for each probe. This setting is given for the product float/water float pair. For specific size, product floats are the same for gasoline and diesel, but water floats have different weights. The values of x for each float type are listed below:

x	type of the float
1	2" stainless for gasoline
2	2" stainless for diesel
3	3" polyurethane for gasoline
4	3" polyurethane for diesel
5	4" polyurethane for gasoline
6	4" polyurethane for diesel

-
- | | |
|---|---------------------------|
| 7 | 2" nitrophyl for gasoline |
| 8 | 2" nitrophyl for diesel |

Example. Probe 01 measures gasoline level and is equipped with 3" polyurethane floats. Float type is configured by:

FT013<CR>

This value is shown as **FloatType** in the output of the RP command.

3.3.10 SELECTING THE RESULT MODE

\$Dn₁n₂x<CR>

By the \$V and \$A inquiry commands the level measured can be sent in three different modes depending on the parameter x stored in the memory as follows:

- | | |
|-------|--|
| x = 0 | result in millimetres |
| x = 1 | result in litres, calculated using the built-in level-to-volume table for a horizontal, cylindrical tank |
| x = 2 | result according to the values stored in the conversion table |

Example. Probe 01 is configured to calculate volume using the built-in level-to-volume table for a horizontal, cylindrical tank by following command:

\$D011<CR>

This value is shown as **ResultMode** in the output of the RP command.

3.3.11 SETTING THE VOLUME OF THE TANK

(This setting is needed only when result mode is set to 1.)

\$Qn₁n₂l₁...l₆<CR>

When using the built-in level-to-volume table (result mode = 1), this command is used to save the volume of a horizontal, cylindrical tank in litres (l₁...l₆).

Example: Probe 01 installed in tank which has 22000 l nominal volume. This is configured by:

\$Q0122000<CR>

This value is shown as **NomVolume** in the output of the RP command.

3.3.12 SETTING THE DIAMETER OF THE TANK

(This setting is needed only when result mode is set to 1.)

\$Rn₁n₂m₁...m₄<CR>

When using the built-in level-to-volume table (result mode = 1), this command is used to save the diameter of a horizontal, cylindrical tank in millimetres m₁...m₄.

Example. Probe 01 is in a tank with 1850 mm diameter. This is set by:

\$R011850<CR>

This value is shown as **Diameter** in the output of the RP command.

3.3.13 ERASING THE CONVERSION TABLE

(This setting is used when result mode is set to 2.)

\$En₁n₂<CR>

This command as all commands affecting the user given conversion table are used only if result mode 2 is selected. Before starting to store new pairs of values in the table, the table pointer must be set to its initial value using this command. (This is thus done only once before programming all 2...32 points in the table).

Example. Erase conversion table used by probe 01:

\$E01<CR>

3.3.14 FILLING IN THE CONVERSION TABLE

(This setting is used when result mode is set to 2.)

\$Fn₁n₂m₁...m₄/l₁...l₆<CR>

Conversions of units and level-to-volume can be made by setting in the conversion table the desired m₁...m₄ readings in millimetres and the corresponding l₁...l₆ values in the desired units. The result to be sent using the \$V inquiry command is calculated linearly between these set points, when the corresponding result mode has been selected. Filling in the table must be started from the lowest level. It is recommended to set 0/0 as the first point. The m₁...m₄ and l₁...l₆ values shall always be higher than those of the previous point. At least two points must be stored; the max. number of these freely selectable points is 32. When storing the points, the current level has no significance. The difference between successive volume readings must not exceed 65000. If the level exceeds the highest table point the volume value is extrapolated using the two highest table point.

Example: Probe 01 volume is calculated with conversion table where 450 mm corresponds to 2000 l, 900 mm to 6000 l, 1350 mm to 13000 l and 1700 mm level corresponds 19500 l volume. This table is configured by following commands:

\$F010/0<CR>

\$F01450/2000<CR>

\$F01900/6000<CR>

\$F011350/13000<CR>

\$F011700/19500<CR>

3.3.15 READING THE CONVERSION TABLE

RTn₁n₂<CR>

This command displays the points stored in the conversion table (level/corresponding reading).

Example of displayed data (5 points stored in the table):

0 0<CR>
450 2000<CR>
900 6000<CR>
1350 13000<CR>
1700 19500#<CR>

3.3.16 SETTING THE NUMBER OF POINTS IN THE CONVERSION TABLE

SXn₁n₂x<CR>

This command sets the number of the points (0...32) in the conversion table and it is used only in special cases when the configured table needs editing.

When the table points are filled, the point count number is automatically incremented. With this command the number of points which are taken into account can be reduced.

Example. In the previous example of filling the conversion table, five points were given. Point count can be set to 3 with following command:

SX013<CR>

And points 4 and 5 can be given again with new values:

\$F011350/14000<CR>

\$F011800/19500<CR>

Points 4 and 5 can be corrected also by using following command.

3.3.17 CORRECTING CONVERSION TABLE POINT

CTn₁n₂p₁p₂m₁...m₄/l₁...l₆<CR>

This command is used to correct values in the conversion table. Number of the point to correct p₁p₂ (01...32).

Example. Correcting point 02 in probe 01 conversion table:

CT0102450/2100<CR>

3.3.18 SETTING THE LOW LEVEL ALARM

\$Ln₁n₂m₁...m₄<CR>

This command is used to set the low level alarm to the desired level m₁...m₄ in millimetres. This setting is necessary only if required by the central unit used.

Example. Alarm level for probe 01 is set to 300 mm by following command:

\$L01300<CR>

This value is shown as **LvlAlarm** in the output of the RP command.

3.3.19 SETTING THE HIGH LEVEL ALARM

\$Hn₁n₂m₁...m₄<CR>

This command is used to set the high level alarm to the desired level m₁...m₄ in millimetres. This setting is necessary only if required by the central unit used.

Example. High level alarm for probe 01 is set 1820 mm:

\$H011820<CR>

This value is shown as **HvlAlarm** in the output of the RP command.

3.3.20 SETTING THE CONDENSEDWATER ALARM

\$Wn₁n₂m₁...m₄<CR>

This command is used to set the water bottom alarm to the desired level m₁...m₄ in millimetres. This setting is necessary only if required by the central unit used.

Example: Water bottom alarm for probe 01 is set to 30 mm:

\$W0130<CR>

This value is shown as **WaterAlarm** in the output of the RP command.

3.3.21 READING PARAMETER VALUES

RPn₁n₂<CR>

This command displays the names of the parameters and their values.

Example. Response to RP command	
WireSpeed = 9.034	Wire speed (3.3.1) of the probe's measuring signal.
Offset = -16.49	This value is calculated when level measurement is set (3.3.3).
WfOffset = 11.0	Water float offset = 11.0 mm (3.3.7).
MinLevel = 82.0	Minimum level = 82.0 mm (3.3.4).
MinWater = 18.0	Minimum water level = 18.0 mm (3.3.8).
MinFloatDist = 65.0	Minimum float distance = 65.0 mm (3.3.6).
FloatType = 3	Float type (3.3.9).
LevelTC = 30	Filter coefficient for level measurement (factory setting).
WaterTC = 30	Filter coefficient for water level measurement (factory setting).
TempTC = 60	Filter coefficient for temperature measurement (factory setting).
ResultMode = 2	Result mode (3.3.10).
Diameter = 1850	Tank diameter = 1850 mm (3.3.12).
NomVolume = 22000	Tank volume = 22000 l (3.3.11).
LvlAlarm = 300	Low level alarm limit = 300 mm (3.3.18).
HlvlAlarm = 1820	High level alarm limit = 1820 mm (3.3.19).
WaterAlarm = 30	Water bottom alarm limit = 30 mm (3.3.20).
TablePoints = 5 #	Number of points in the conversion table (3.3.13 – 3.3.16).

All rows end with <CR>.

4. INQUIRY COMMANDS

All the following basic inquiry commands are compatible with LABKO ILS protocol used in LABKO 2000 capacitive level probes.

4.1 LEVEL/VOLUME INQUIRY

\$Vn₁n₂<CR>

By this command probe n₁n₂ sends the result in the mode that is preset by the \$D command.

Response:

#xl₁...l₆<CR>

or

#xl₁...l₆_LLA<CR>

or

#xl₁...l₆_HLA<CR>

where	x	1 = condensed water alarm 0 = no condensed water alarm
	l ₁ ...l ₆	= result in units according to preset parameters (result mode), 1...6 digits
	LLA	= low level alarm
	HLA	= high level alarm
	—	= space

4.2 LEVEL INQUIRY

\$Mn₁n₂<CR>

By this command probe n₁n₂ sends the level in millimetres (irrespective of the result mode) in the same mode as the \$V command when the result mode is 0.

4.3 TEMPERATURE INQUIRY

\$Tn₁n₂<CR>

By this command probe n₁n₂ sends the temperature of the measured liquid.

Response:

#+/-t₁...t₃<CR>

where	+/-	= + or - sign
	t ₁ ...t ₃	= temperature reading, 1...3 digits, scaled as follows: 6 = 0.6°C 84 = 8.4°C 237 = 23.7°C

4.3.1 TEMPERATURE INQUIRY FOR FIVE TEMPERATURES

Certain versions of LabkoMax and LabkoFlex probes support five temperature readings.

TA_{n₁n₂}<CR>

By this command probe n₁n₂ sends the readings of all five temperature measurements. The lowest measurement point is represented first in the response. The highest measurement point is represented last in the response.

This feature is supported from MPS-4 software version v2.10 onwards.

Response:

#+/-t₁...t₃ +/-t₁...t₃ +/-t₁...t₃ +/-t₁...t₃ +/-t₁...t₃

where +/- = + or - sign
 t₁...t₃ = temperature reading, 1...3 digits, scaled as follows:
 6 = 0.6°C
 84 = 8.4°C
 237 = 23.7°C

Example:

TA01<CR>

Response:

#+229 +229 +230 +229 +232

4.4 CONDENSED WATER LEVEL INQUIRY

\$G_{n₁n₂}<CR>

By this command probe n₁n₂ sends the water level on the bottom of the tank. (The measurement is possible only for non-conductive liquids, such as fuels.)

Response:

#m₁...m₄<CR>

where m₁...m₄ = water level in millimetres, 1...4 digits

4.5 WATER LEVEL/VOLUME INQUIRY

WV_{n₁n₂}<CR>

Response:

#l₁...l₆<CR>

where l₁...l₆ = result in units according to preset parameters (result mode)

4.6 ALL VALUES INQUIRY

\$A_{n₁n₂}<CR>

By this command probe n₁n₂ sends the level in tenths of millimetres, volume, temperature, water level and possible alarms.

Response:

#m₁...m₅;v₁...v₆;t₁...t₄;g₁...g₄;WHL<CR>

where ; = field separator (semicolon)

m₁...m₅ = level as an integer in tenths of mm (1...5 digits)

v₁...v₆ = level/volume according to result mode (1...6 digits)

t₁...t₄ = temperature as an integer in tenths of °C (t₁ can also be a minus sign, 1...4 characters)

g₁...g₄ = water level in millimetres (1...4 digits)

W = condensed water alarm

H = high level alarm

L = low level alarm

The contents of the v₁...v₆ reading is determined by the result mode (set by the \$D command) and indicates either the level in millimetres or the volume in litres.

The alarm flags W, L and H appear in this order and always one after another without spaces. When an alarm is switched off, it will not be replaced by a space. Example: When the water bottom and low level alarms are on, the alarm field will be: WL<CR>.

5. ADDITIONAL INQUIRY COMMANDS

5.1 PROBE STATUS INQUIRY

RE n₁n₂<CR>

Response to this command is probe n₁n₂ error status.

If there are no errors then response is:

#00<CR>

Non-zero response indicates error type:

01 no probe connected

02 data error

04 low voltage

08 floats are too close to each other

40 probe reading is not yet accurate

80 measurement is not yet performed for the probe

6. MAINTENANCE

6.1 HARDWARE FAULTS

MPS-4 unit's mains fuse which is located in the lower left corner of the unit (marked 125mAT), can be changed to an other IEC127 50x20mm/125mAT glass tube fuse if appropriate safety measures are used.

Any other maintenance operations can be carried out only by persons experienced in Ex-installations and authorized by Labkotec Oy.

Service, inspection and repair of Ex-apparatus needs to be done according to standards IEC 60079-17 and IEC 60079-19.



6.2 MEASURING FAULTS

If measured values are not correct, it would help to solve the problem if following data from MPS-4 unit is available when contacting the manufacturer:

- Result of RP command (ref. 3.3.19).
- Result of RE command (ref. 5.1).

Declaration of Conformity

This declaration certifies that the below mentioned apparatus conforms to the essential requirements of the EMC directive 89/336/EEC (as amended by 91/263/EEC and 92/31/EEC), Low-Voltage directive (LVD) 2006/95/EY and ATEX directive 94/9/EC.

Description of the apparatus:

This device is a power supply unit, zener barrier and an interface unit for LabkoMax® level measurement probes.

Type: MPS-4

Manufacturer: Labkotec Oy
Myllyhaantie 6 33960 Pirkkala, FINLAND

The construction of the appliance is in accordance with the following standards:**EMC:**

EN 50081-1 (1992),	Electromagnetic compatibility, Generic emission standard, class: Residential, commercial and light industry.
EN 50082-1 (1997),	Electromagnetic compatibility, Generic immunity standard, class: Residential, commercial and light industry.
EN 50082-2 (1995),	Electromagnetic compatibility, Generic immunity standard, Part 2: Industrial environment.
EN 61326 (1997) + A1:1998	Electrical equipment for measurement, control and laboratory use - EMC requirements.
EN 61000-3 Part 2 (1995)	Electromagnetic compatibility (EMC), Limits for harmonic current emissions (equipment input current up to and including 16 A per phase)
EN 61000-3 Part 3 (1995)	Electromagnetic compatibility (EMC), Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current up to and including 16A.
ENV 50204 (1995)	Radiated electromagnetic field from digital radio telephones - immunity test

LVD:

EN 61010-1(1993) +A2(1995)	Safety requirements for electrical equipment for measurement, control and laboratory use. Part 1: General requirements, Amendment A2.
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ATEX:

EN 60079-0 (2009)	Electrical apparatus for potentially explosive atmospheres. Part 0: General requirements
EN 60079-11 (2007)	Electrical apparatus for potentially explosive atmospheres. Part 11: Equipment protection by intrinsic safety "I"

EC-type examination certificate: VTT 03 ATEX 079X

Ex-classification:  II (1) G [Ex ia] IIB T5 Ta = -25°C...+50°C

Production quality assessment notification: VTT 01 ATEX Q 001

Notified Body: VTT Expert Services Ltd; notified body number 0537.
Address of the notified body: P.O. Box 1001, FI-02044 VTT

The product is CE-marked since 2001.

Signature

The authorized signatory to this declaration, on behalf of the manufacturer, and the Responsible Person based within the EU, is identified below.

Pirkkala 19.9.2011


Markku Helminen
CEO
Labkotec Oy

Declaration of Conformity

Manufacturer: AMETEK Automation & Process Technologies
1080 North Crooks Road, Clawson, MI 48017 USA

Identification of Equipment:
7100M and 7100K Liquid Level Transducer

Description of Device:

The device is a permanently mounted liquid level probe. It determines the level of a liquid based on signal reflections, caused by magnetic floats, in a wire running the length of the probe. These signals are amplified and processed, then relayed via a signal imposed on the input wires to the probe. The probe body and tube may be constructed of stainless steel or of a flexible PVDF polymer. These devices also take liquid level temperature measurements using thermistors located in the probe tube.

EC type certificate: DEMKO 03ATEX0319425
Quality certificate: KEMA 03ATEXQ3161

Conformity Specifications:

Council Directives:

Directive 94/9/EC, ATEX
Directive 89/336/EEC, EMC
Directive 73/23/EEC, Low Voltage

Harmonized Standards:

EN50014:1997	Electrical apparatus for potentially explosive atmospheres - General requirements
EN50020:2002	Electrical apparatus for potentially explosive atmospheres - Intrinsic Safety 'i'
EN50284:1999	Special requirements for construction, test and marking of electrical apparatus of equipment group II, Category 1 G
EN55011:1998	Limits and methods of measurement of radio characteristics of industrial, scientific and medical (ISM) Radio Frequency equipment, Class B, Group 1
EN50082-1:1992	Electromagnetic compatibility Generic immunity standard Part 1. Residential, commercial and light industry
IEC 801-2:1984	ESD Susceptibility
IEC 801-3:1984	Radiated Susceptibility, Electromagnetic Field
IEC 801-4:1988	Conducted Susceptibility, Burst Interference Transients
EN61010-1:1993	Safety Requirements for Electrical Equipment for Measurement, Control, and laboratory Use

Signed:



Name: Jack Pattee **Dated:** 7/28/03
Position: Director of Engineering **Company:** AMETEK Automation & Process Technologies